Tab A

Appendix A

Blanketing Interference

Broadcast Signal Lab

Blanketing Interference

Definition of Blanketing

To date, we have not identified a well-sourced definition of blanketing interference, other than the technical criteria discussed below. In 47 CFR § 73.318, the FCC defines a *blanketing area*, described below, in which blanketing interference may occur. An *ad hoc* definition of blanketing interference describes it as a form of interference caused by the presence of an overwhelmingly strong signal that suppresses or severely hampers a receiver's ability to receive other signals. It may be manifest as the monopolizing, desensitizing or total disabling of the receiver. Blanketing interference may include adjacent channel interference when such occurs in the blanketing area, but it is capable of interfering with the reception of any desired signal regardless of channel adjacency to that signal.

Blanketing Areas for LPFM Stations

The FCC, in 47 CFR § 73.318, defines FM blanketed area radius as the calculated 115 dBu field intensity contour without regard to antenna height or vertical radiation pattern. The formula given is

$$D \text{ (in km)} = 0.394 \sqrt{P} \quad \text{or} \quad D \text{ (in miles)} = 0.245 \sqrt{P}$$

where P is the maximum effective radiated power, in kilowatts, of the maximum radiation lobe. This formula derives from the established relationship of radiated power, distance and field strength in free space. For convenience at lower power levels it may be restated as

$$D \text{ (in meters)} = 12.47 \sqrt{P} \quad \text{or} \quad D \text{ (in feet)} = 40.92 \sqrt{P}$$

where P is measured in watts.

The calculated blanketing area radii for several power levels ranging from one watt to one kilowatt are tabulated below.

Table 1. Effective radiated power versus blanketing area radius

ERP watts	blanketing area radius meters (feet)
1,000	394 (1294)
500	279 (915)
100	125 (409)
50	88 (289)
10	39 (129)
2	18 (58)
1	12 (41)

To gain some notion of how many individuals might be in the blanketing area of an LPFM station located in a densely populated area, let us assume a population density of 30,000 per square mile, a figure not unusual for urban areas. Further assume homogeneous population distribution, keeping in mind that departures from homogeneity will affect the accuracy of predictions increasingly as power and area diminish. Based on these assumptions, we obtain the results in the next table.

Table 2. Effective radiated power versus population within blanketing area

ERP watts	estimated number of persons within blanketing area
1,000	5,700
100	570
10	57
1	6

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Blanketing in the Test Procedure

The test procedure was conducted in reference to the FCC interference protection ratios for commercial FM stations. At second and third adjacent channels the undesired signal level is permitted to be 40 dB greater than the theoretical desired signal level. At the 60 dBu protected contour of many stations, the undesired second and third adjacent signals would be permitted to be 60 dBu + 40 dB = 100 dBu.

Increasing the level of the undesired test signal on the test bed results in signal levels that approach and surpass the 115 dBu value that the FCC uses to define blanketing area. (On second, third and fourth adjacent channels this level is approximately between the FCC+10 and +20 test levels). Each receiver that was tested exhibited its own characteristic response to increasing levels of undesired signal on the adjacencies. No clear pattern emerged that could be associated with the 115 dBu blanketing area figure established by the FCC.

The FCC figure of 115 dBu is used to describe a geographic area within which a radio broadcaster has certain responsibilities regarding blanketing interference. Therefore, the 115 dBu figure is not necessarily a blanketing interference threshold for all radios. Receiver performance confirms this observation.

Implications to Blanketing Interference Analysis

In Table 2 above, rule of thumb figures are given for population within FCC blanketing areas for various transmitted power levels. The population affected by blanketing *interference* can be expected to be less than the population within the blanketing *area*. This conclusion is based on two factors. Antenna height and vertical pattern are not considered in defining the blanketing area, so actual signal levels will typically be lower than 115 dBu. Second, many of the radios in the test performed successfully with undesired signals at and above the equivalent 115 dBu level. Thus the blanketing area is a very conservative construct intended to assure a thorough response to blanketing interference concerns near a transmitter. Assuming homogeneous population distribution, the population figures presented in Table 2 therefore inherently overestimate potentially affected population.
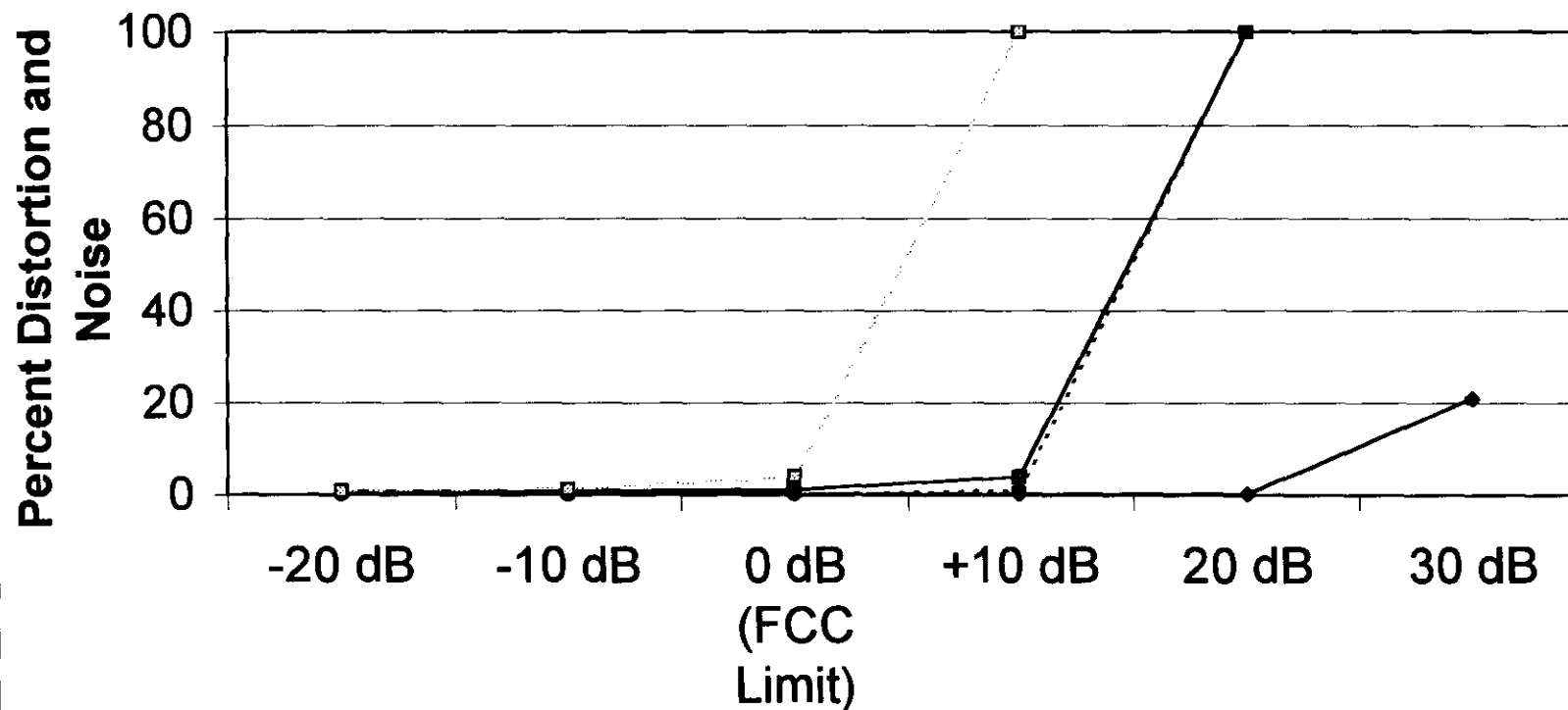
Tab B

Appendix B

Graphs:

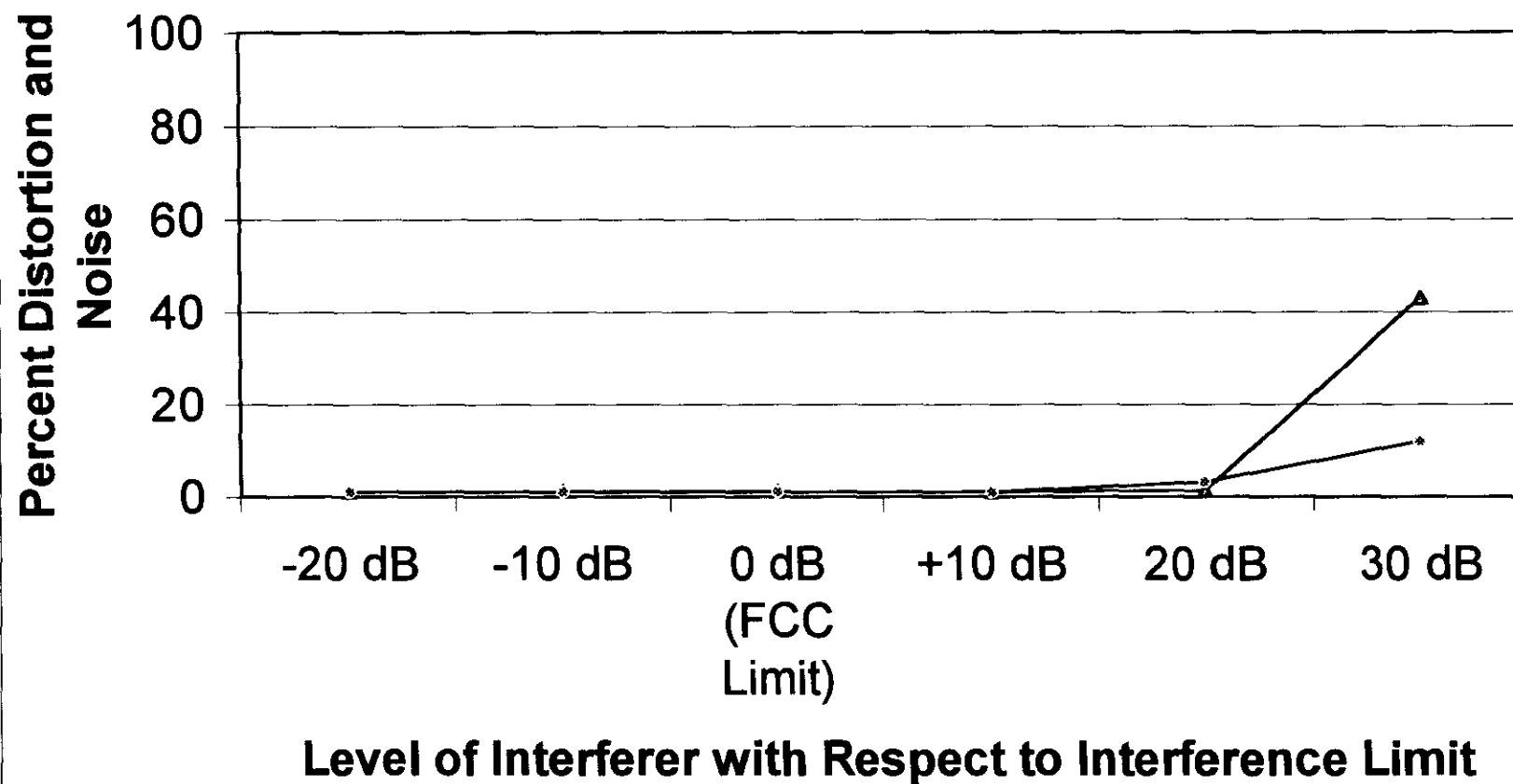# Comparison of THD+N Performance

--By Radio Type and Adjacency

Comparative 1st Adjacent Performance - Higher Price Units - Stereo Tone on Interferer

Percent Distortion and Noise

100

80

60

40

20

0

-20 dB   -10 dB   0 dB (FCC Limit)   +10 dB   20 dB   30 dB

Level of Interferer with Respect to Interference Limit

— ♦ — #9, NAD, Tuner   — ■ — #8, Technics, Component

··· ♦ ··· #4, Denon, NAB Tuner   ··· □ ··· #1, Marantz, Component

Comparative 1st Adjacent Performance - Car Radios - Stereo Tone on Interferer

Percent Distortion and Noise

100
80
60
40
20
0

-20 dB -10 dB 0 dB (FCC Limit) +10 dB 20 dB 30 dB

Level of Interferer with Respect to Interference Limit

#10, Ford, Car Stereo #3, Matsushita, Car Stereo

Comparative 1st Adjacent Performance - Lower Price Units - Stereo Tone on Interferer

Percent Distortion and Noise

100
80
60
40
20
0

-20 dB   -10 dB   0 dB (FCC Limit)   +10 dB   20 dB   30 dB
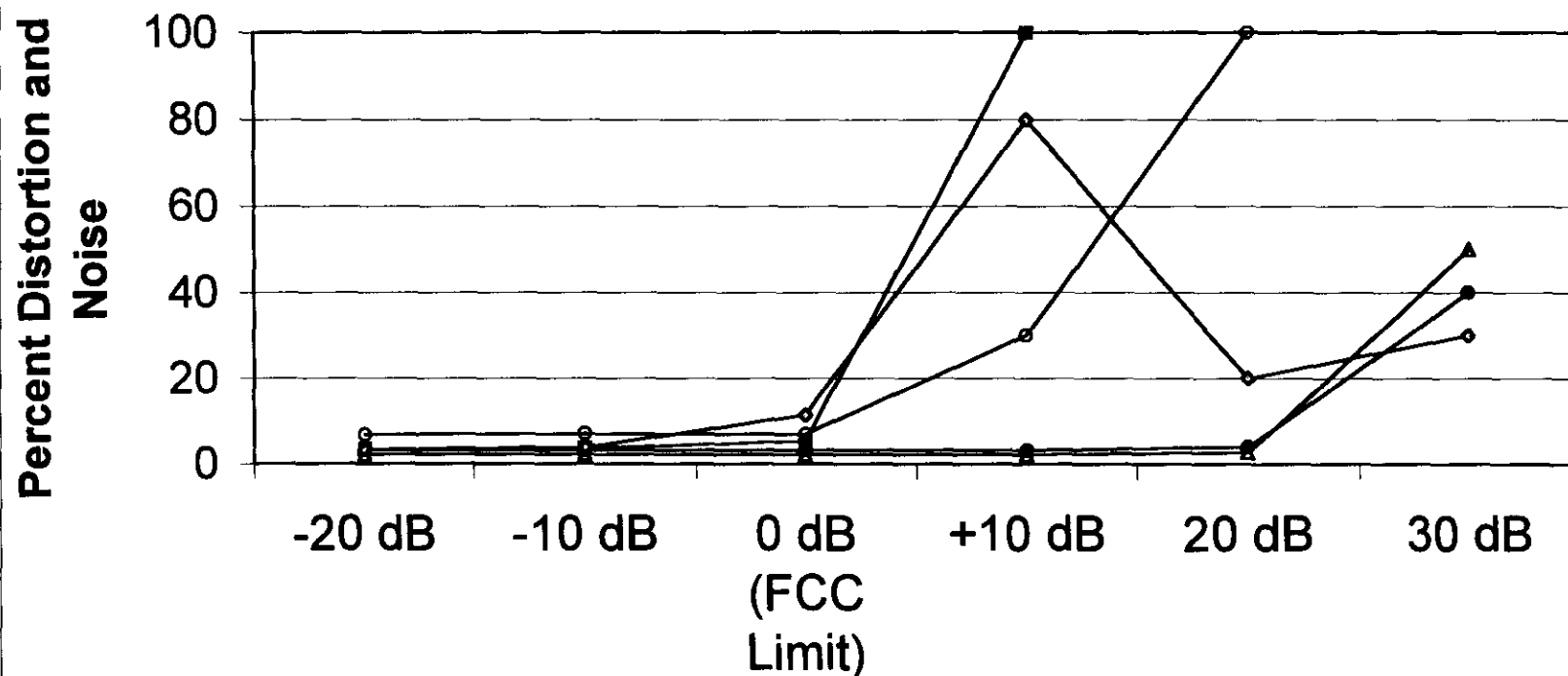
Level of Interferer with Respect to Interference Limit

- #11, Aiwa, Integrated Sys
- #7, Sony, Boom Box
- #6, Aiwa, Boom Box
- #5, Sony, Clock Radio
- #2, Sony, Walkman

Comparative 2nd Adjacent Performance - Higher Price Units- Stereo Tone on Interferer

Percent Distortion and Noise (y-axis: 0, 20, 40, 60, 80, 100)

Level of Interferer with Respect to Interference Limit (x-axis: -20 dB, -10 dB, 0 dB (FCC Limit), +10 dB, 20 dB, 30 dB)

- -•- #9, NAD, Tuner
- —•— #8, Technics, Component
- ··▲·· #4, Denon, NAB Tuner
- —□— #1, Marantz, Component

Comparative 2nd Adjacent Performance - Car Radios- Stereo Tone on Interferer
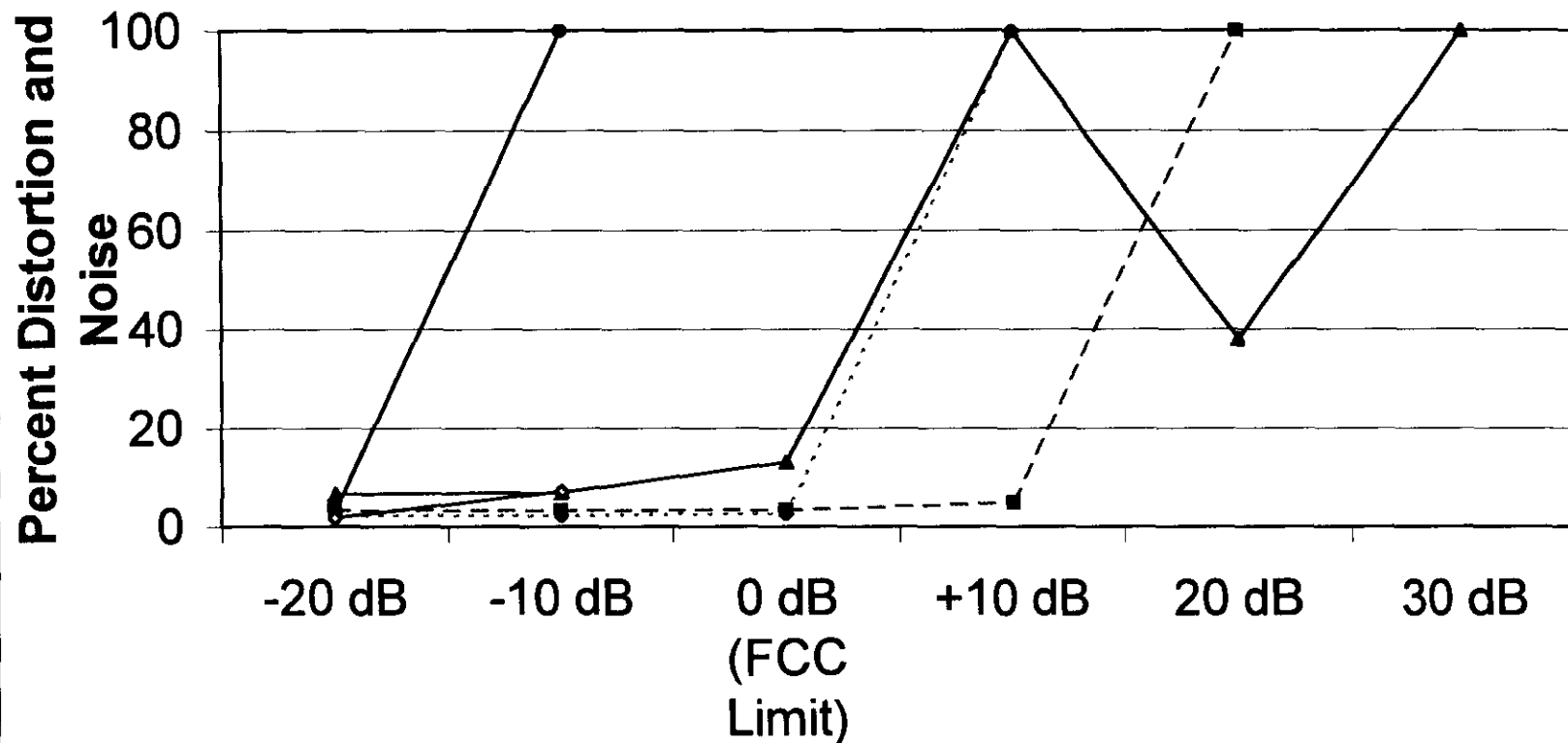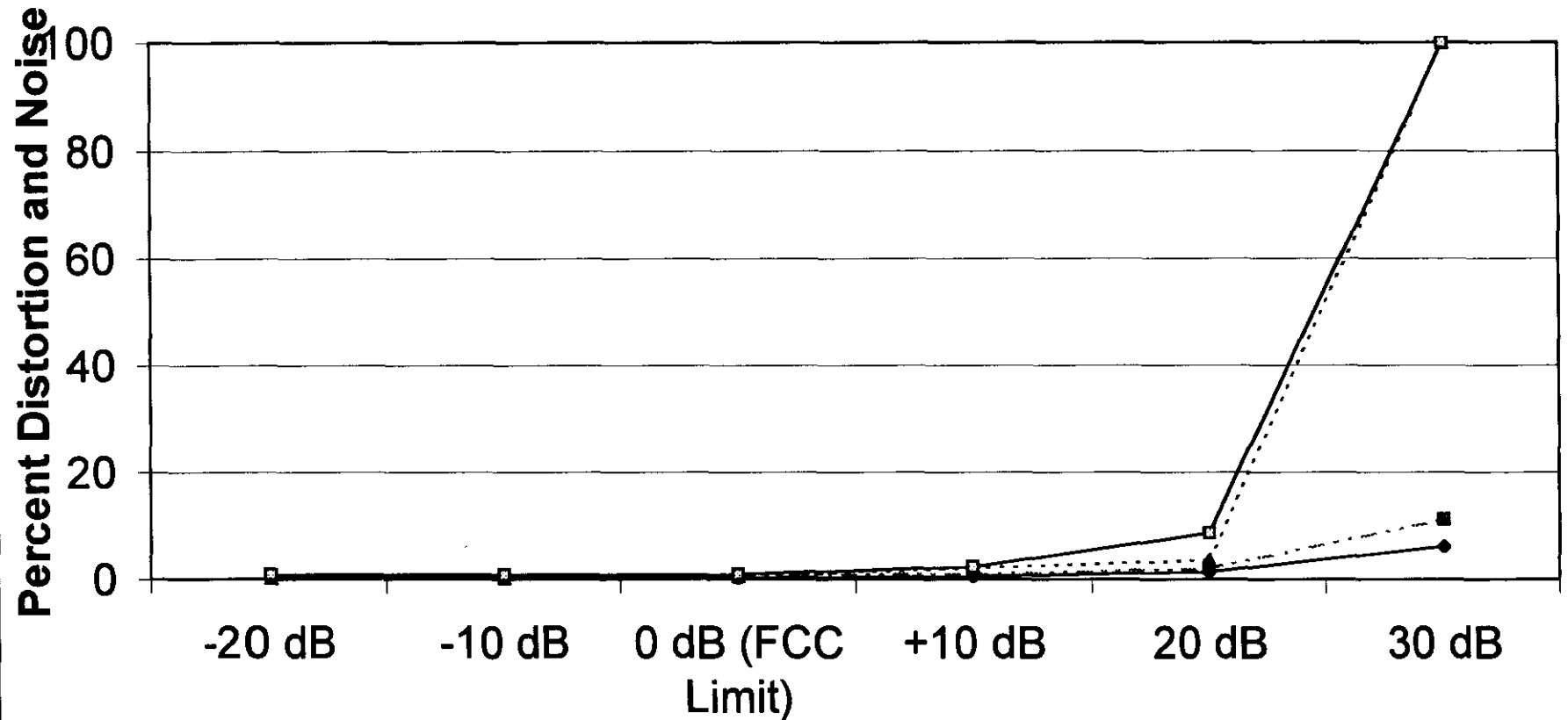

Level of Interferer with Respect to Interference Limit

Y-axis: Percent Distortion and Noise (0, 20, 40, 60, 80, 100)

X-axis: -20 dB, -10 dB, 0 dB (FCC Limit), +10 dB, 20 dB, 30 dB

Legend: —▲— #10, Ford, Car Stereo   —■— #3, Matsushita, Car Stereo

Comparative 2nd Adjacent Performance - Lower Price Units- Stereo Tone on Interferer

Y-axis: Percent Distortion and Noise (0, 20, 40, 60, 80, 100)

X-axis: -20 dB, -10 dB, 0 dB (FCC Limit), +10 dB, 20 dB, 30 dB

Level of Interferer with Respect to Interference Limit

– ■ – #11, Aiwa, Integrated Sys   —▲— #7, Sony, Boom Box
—●— #6, Aiwa, Boom Box   ··◆·· #5, Sony, Clock Radio
—◇— #2, Sony, Walkman (Incomplete data)

Comparative 3rd Adjacent Performance - Higher Price Units - Stereo Tone on Interferer

A line chart with x-axis "Level of Interferer with Respect to Interference Limit" showing values -20 dB, -10 dB, 0 dB (FCC Limit), +10 dB, 20 dB, 30 dB; and y-axis "Percent Distortion and Noise" ranging from 0 to 100.
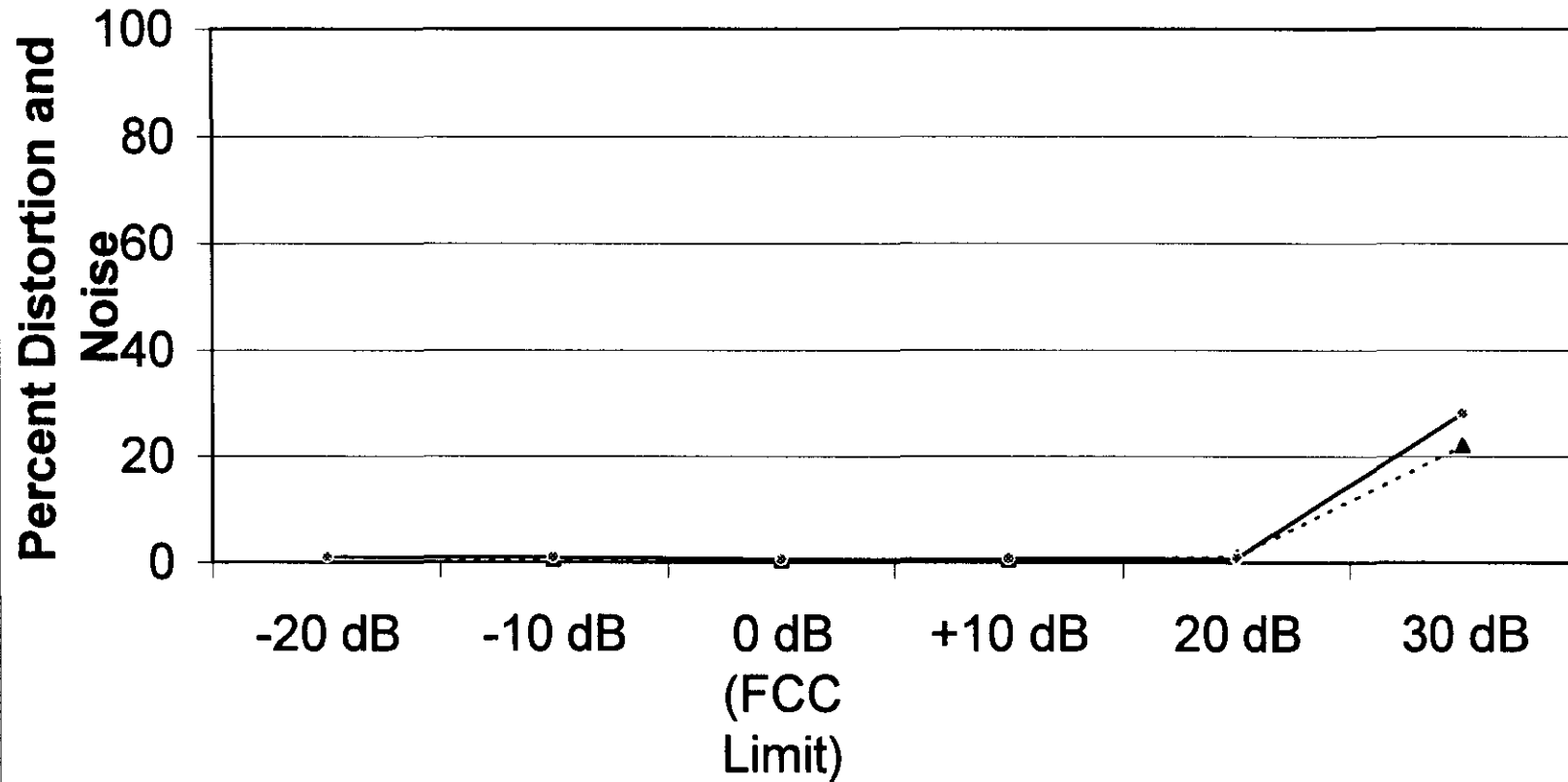
Legend:
- #9, NAD, Tuner
- #8, Technics, Component
- #4, Denon, NAB Tuner
- #1, Marantz, Component

Comparative 3rd Adjacent Performance - Car Radios - Stereo Tone on Interferer

Percent Distortion and Noise

100

80

60

40

20

0

-20 dB -10 dB 0 dB (FCC Limit) +10 dB 20 dB 30 dB

Level of Interferer with Respect to Interference Limit

- · ▲ · · #10, Ford, Car Stereo —·— #3, Matsushita, Car Stereo

Comparative 3rd Adjacent Performance - Lower Price Units - Stereo Tone on Interferer

Percent Distortion and Noise

100
80
60
40
20
0

-20 dB   -10 dB   0 dB (FCC Limit)   +10 dB   20 dB   30 dB

Level of Interferer with Respect to Interference Limit
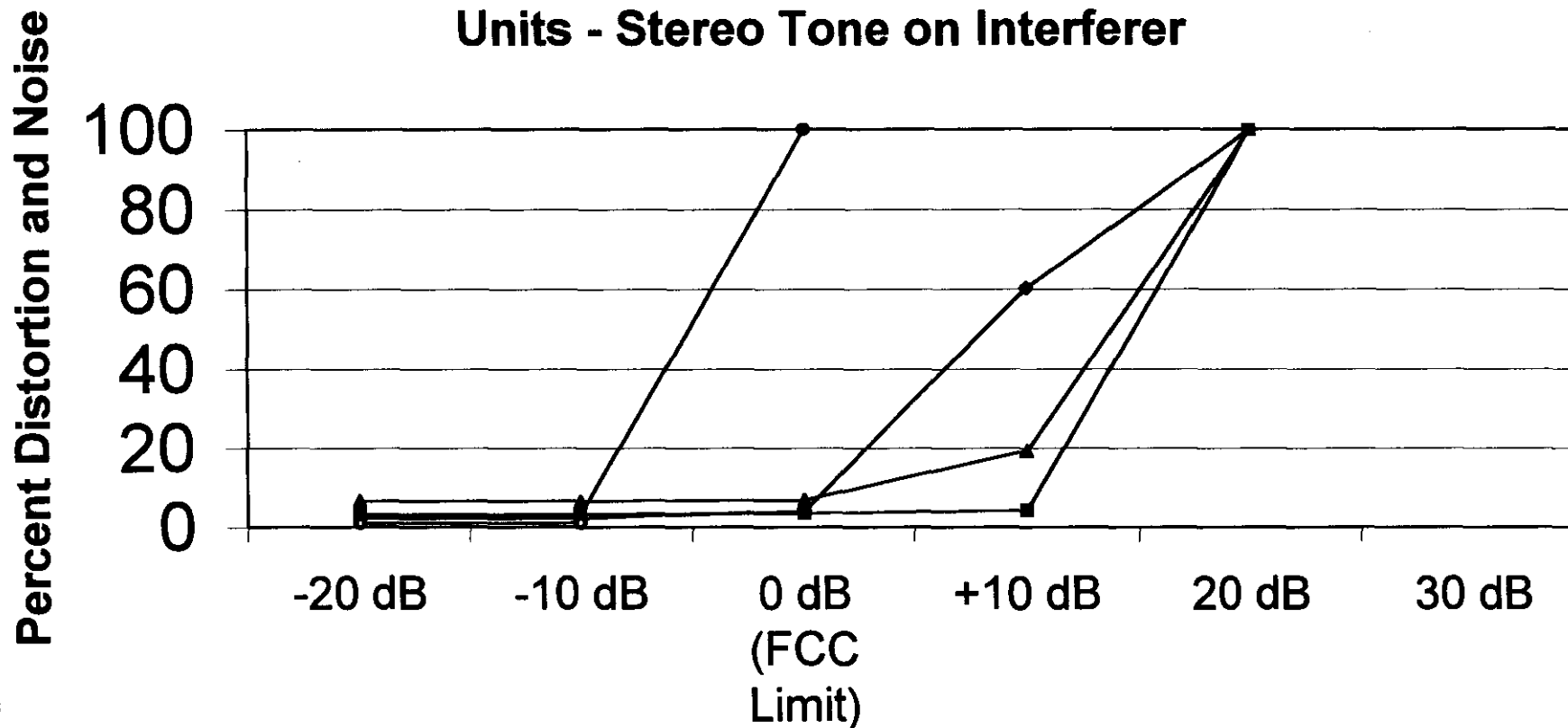
- #11, Aiwa, Integrated Sys
- #6, Aiwa, Boom Box
- #2, Sony, Walkman (Incomplete data)
- #7, Sony, Boom Box
- #5, Sony, Clock Radio

Tab C

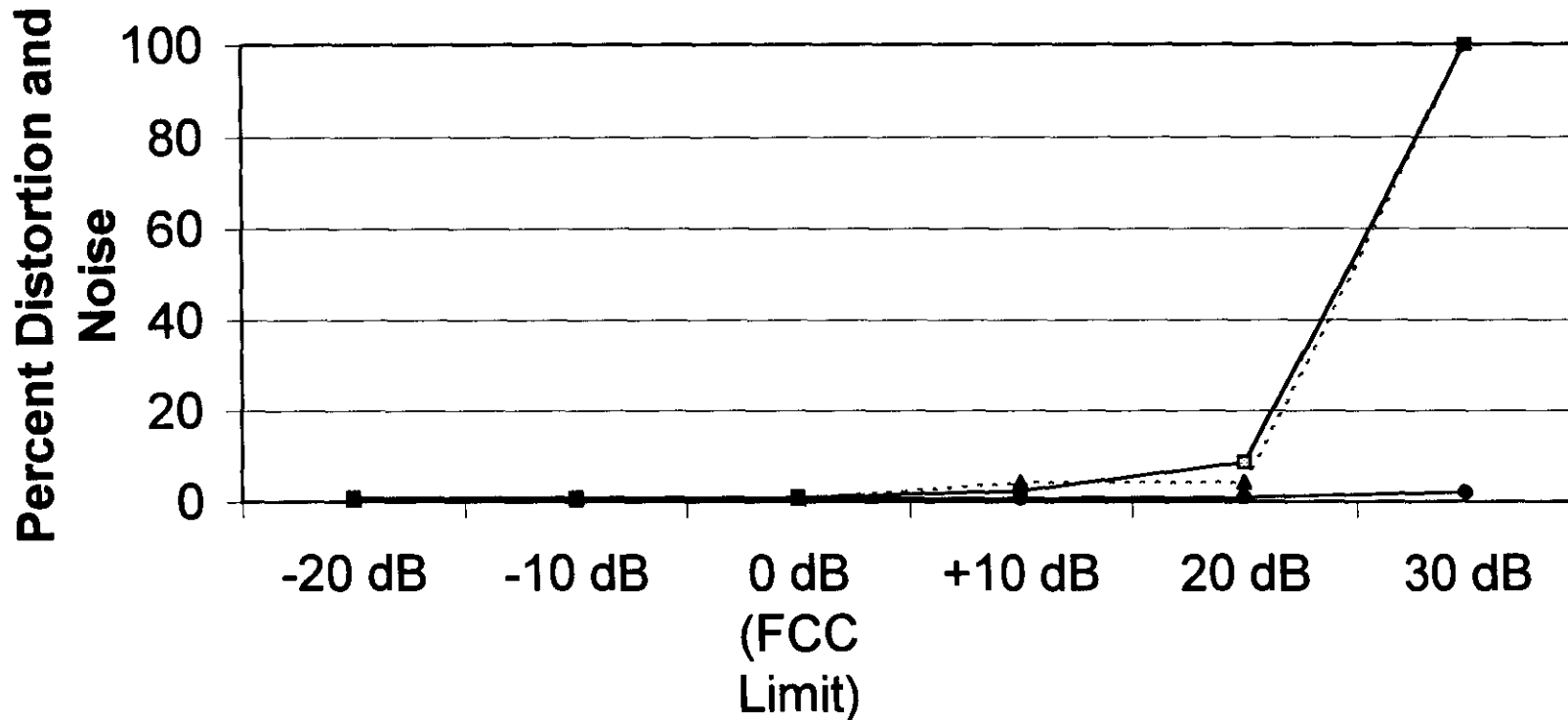# Appendix C

Graphs:

Comparison of Radio Performance against 2nd, 3rd and 4th Adjacencies

--By Radio

Comparative 2nd, 3rd, & 4th Adjacent Performance - Marantz Component - Stereo Tone on Interferer

Y-axis: **Percent Distortion and Noise** — 0, 20, 40, 60, 80, 100

X-axis: **Level of Interferer with Respect to 2nd &3rd Interference Limit** — -20 dB, -10 dB, 0 dB (FCC Limit), +10 dB, 20 dB, 30 dB

Legend:
- —□— #1, Marantz, Component, 3rd Adj
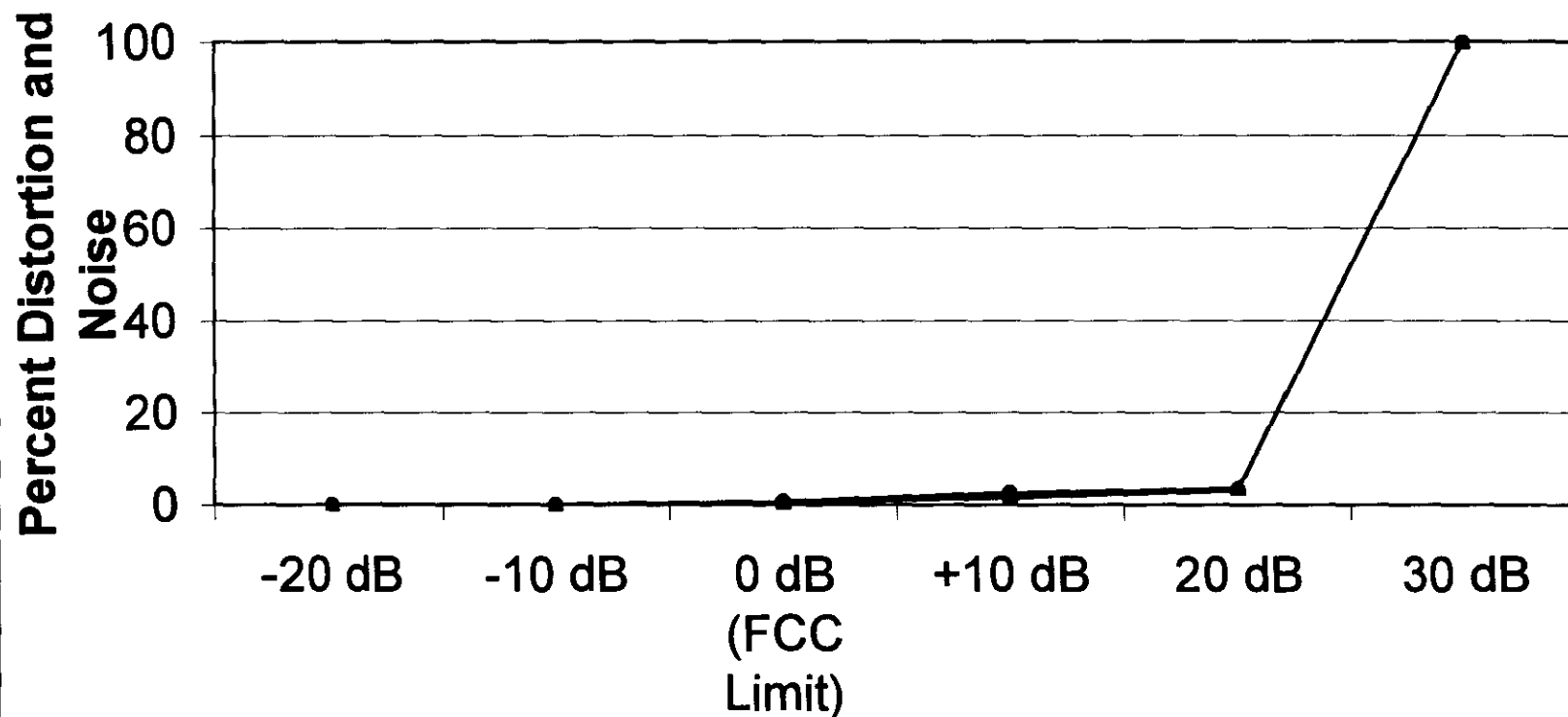- —●— #1, Marantz, Component, 2nd Adj
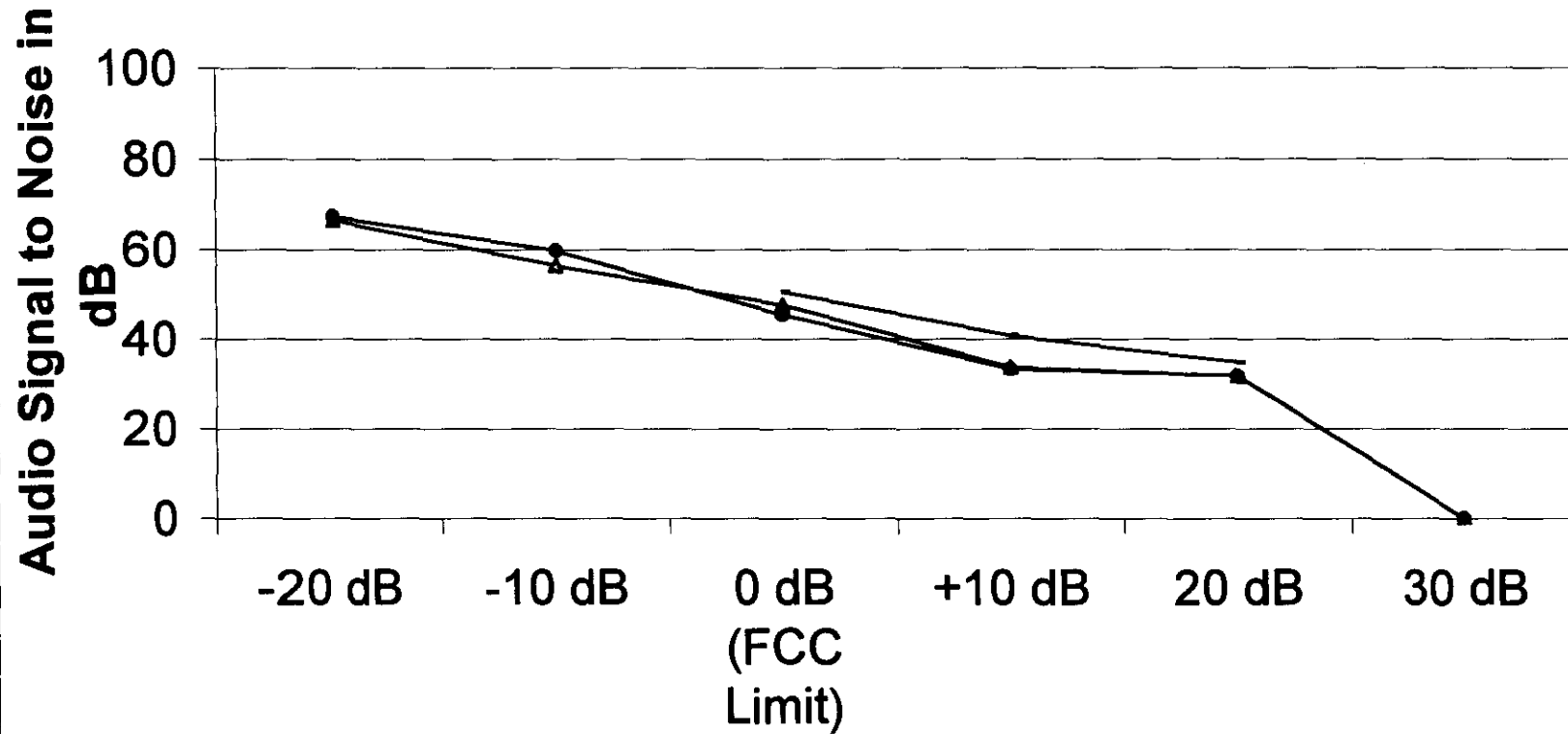- ··▲·· #1, Marantz, Component, 4th Adj

Comparative 2nd, 3rd, & 4th Adjacent Performance - Marantz Component - Stereo Tone on Interferer

Level of Interferer with Respect to 2nd &3rd Interference Limit

—□— #1, Marantz, Component, 3rd Adj   —●— #1, Marantz, Component, 2nd Adj
···▲··· #1, Marantz, Component, 4th Adj

Comparative 2nd, 3rd, & 4th Adjacent Performance - Denon NAB Tuner - Stereo Tone on Interferer

Percent Distortion and Noise

100
80
60
40
20
0

-20 dB   -10 dB   0 dB (FCC Limit)   +10 dB   20 dB   30 dB

Level of Interferer with Respect to 2nd & 3rd Interference Limit

— #4, Denon, NAB Tuner, 4th Adj   —▲— #4, Denon, NAB Tuner, 3rd Adj
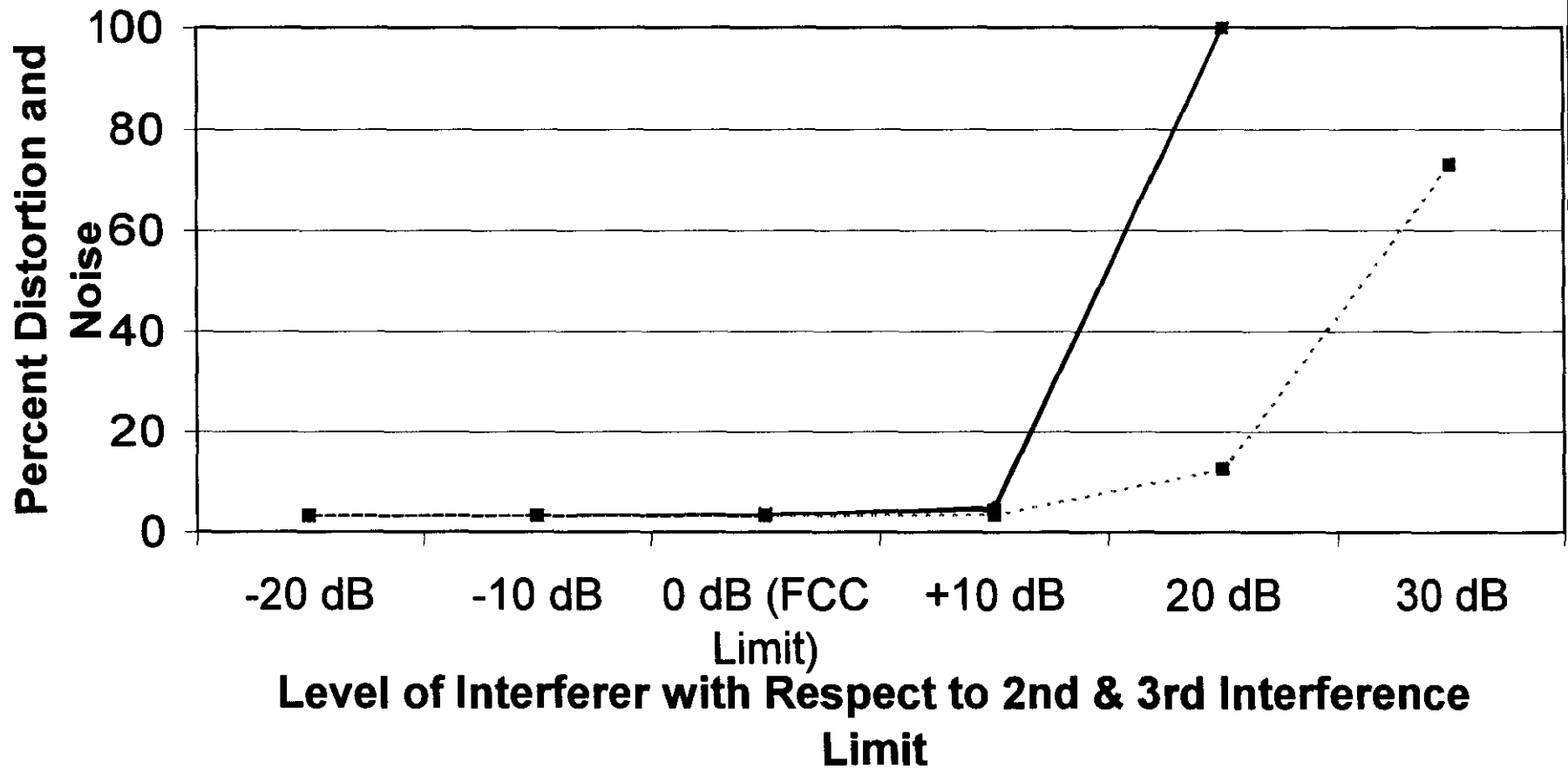—●— #4, Denon, NAB Tuner, 2nd Adj

Comparative 2nd, 3rd, & 4th Adjacent Performance -
Denon NAB Tuner - Stereo Tone on Interferer

Audio Signal to Noise in dB

100
80
60
40
20
0

-20 dB   -10 dB   0 dB (FCC Limit)   +10 dB   20 dB   30 dB

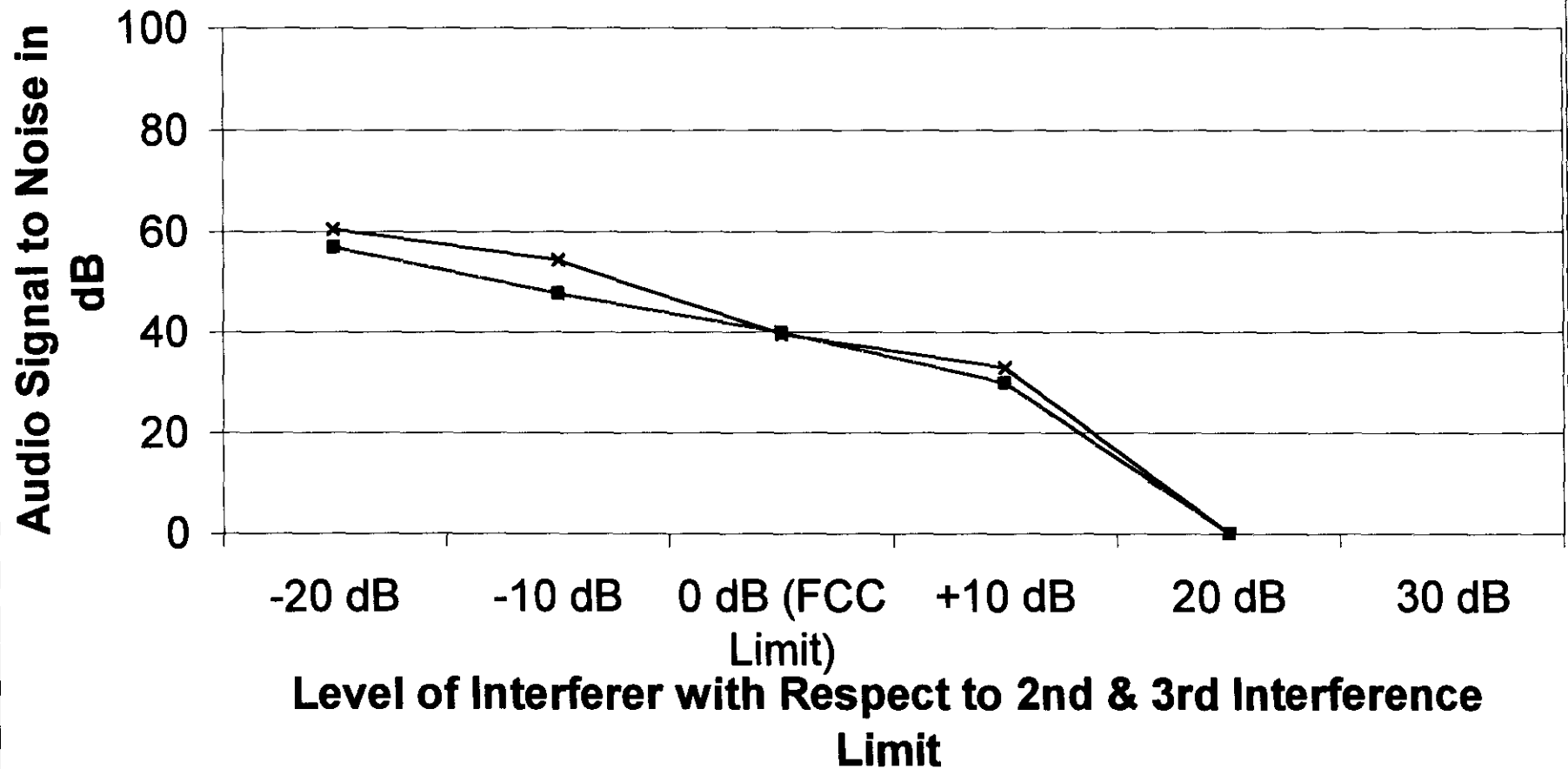Level of Interferer with Respect to 2nd & 3rd Interference Limit

— #4, Denon, NAB Tuner, 4th Adj   —▲— #4, Denon, NAB Tuner, 3rd Adj
—●— #4, Denon, NAB Tuner, 2nd Adj

Comparative 2nd, 3rd, & 4th Adjacent Performance -
Aiwa Integrated Sys - Stereo Tone on Interferer

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May 1999

Comparative 2nd, 3rd, & 4th Adjacent Performance - Aiwa Integrated Sys - Stereo Tone on Interferer

Level of Interferer with Respect to 2nd & 3rd Interference Limit

Audio Signal to Noise in dB

—×— #11, Aiwa, Integrated Sys, 3rd Adj   —◆— #11, Aiwa, Integrated, 2nd Adj

··■·· #11, Aiwa, Integrated, 2nd Adj

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May 1999